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IDENTIFIER:  
TITLE: OPTICAL DISK REPRODUCING METHOD AND OPTICAL DISK  
DEVICE

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ABSTRACT:

PROBLEM TO BE SOLVED: To increase the retention rate of look-ahead data in such a manner that another look-ahead is made possible while data are transferred from one of storage means, and to increase the speed of data transfer by the reduction of the seek between layers, by providing temporary storage means independent for every layer of a recording medium having plural recording layers.

SOLUTION: Cache buffer memories 14, 15 are provided corresponding to the 1st and 2nd recording layers of the optical disk 11. The data requested to read for the 1st layer are read out on the storage area of the buffer memory 14 and transferred to a data processing part 16, and the look-ahead is proceeded for the 1st layer with a pickup module 12 by a controller 17 until the read for the 2nd layer is requested. When the read is requested for the 2nd layer, the data are read out on the storage area of the buffer memory 15, and the look-

ahead for the 2nd layer is continued after transferred to the data processing part 16. When the read is requested for the 1st layer, the data are transferred from the buffer memory 14, but the look-ahead is continued for the 2nd layer.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the optical disk playback approach in case especially an optical disk is two-layer structure about the optical disk unit which reproduces the information recorded on the optical disk.

[0002]

[Description of the Prior Art] The CD-ROM driving gear has spread as a data regenerative apparatus of a computer. While the application software which treats a mass data like image data increases, the development efforts whose CD-ROM driving gear also accelerates reproduction speed corresponding to this are continued.

[0003] Next, this CD-ROM driving gear is made into an example, and the conventional optical disk unit is explained. Drawing 3 is the configuration block Fig. of the conventional optical disk unit. For an optical pickup module and 3, as for cache buffer memory and 6, in drawing 3, the access-control section and 4 are [ 1 / an optical disk (CD-ROM) and 2 / the data-processing section and 7 ] controllers.

[0004] Drawing 4 is the flow chart of the buffer control program of the controller 7 of drawing 3.

Hereafter, according to drawing 4, it explains for every step of operation. The access-control section 3 controls actuation of the optical pickup module 2 by focal control, tracking control, and spindle control.

[0005] First, a controller 7 starts an optical disk unit, applies a servo in order of focal control, tracking control, and spindle control, and enables it to read the data of an optical disk 1 from the optical pickup module 2 (S1). A controller 7 waits for the lead demand from the data-processing section 6 (S2).

Generating of a lead demand performs the extract of a lead starting address and the number of lead demand sectors to the generated lead demand. According to the extracted address, it searches whether the target data are on the cache buffer memory 4 (S3).

[0006] When there are data, the target data are transmitted to the data-processing section 6 (S10). A transfer makes an availability the part which was repeated about the demanded number of sectors (S11), and was transmitted, and starts a read ahead of new data (S12). Data are read when there are no data. Temporarily, suppose that the address and the number of sectors which were extracted were the 100th 1 sector. It seeks in order to read data from the 100th street of an optical disk 1 with the optical pickup module 2 (S4). Buffering initiation of the read data is carried out from the head of the cache buffer memory 4 (S5 S6), an error correction is given, and only 1 sector is transmitted to the data-processing section 6 (S7). The data of the 101st henceforth which was not transmitted are buffered and stored in the cache buffer memory 4 as read-ahead data. Buffering is repeated while an opening is in the cache buffer memory 4 (S8).

[0007] Temporarily, supposing the capacity of the cache buffer memory 4 is a part for 50 sectors, it is buffered to the 150th street. If an opening is lost to the cache buffer memory 4, buffering will be in a standby condition until it is stopped and an opening occurs (i.e., until the next lead demand occurs). (S2) Or it searches whether again, when a lead demand occurs in the midst (S2) which predicts data, the extract of a lead starting address and the number of lead demand Seta is performed to it to the generated

lead demand, and the target data are in it on the cache buffer memory 4 (S3).

[0008] When there are data, the target data are transmitted to the data-processing section 6 (S10). A transfer makes an availability the part which was repeated about the demanded number of sectors (S11), and was transmitted, and continues a read ahead of new data (S12).

[0009] When there are no data, the read ahead till then is interrupted, it seeks according to the extracted address, and read-out of (S4) and data is started (S5). The read data are buffered from the head of the cache buffer memory 4 (S6), and an error correction is given to them and they are transmitted to the data-processing section 6 about the demanded number of sectors (7 S 8). The data which were not transmitted are buffered and stored in the cache buffer memory 4 as read-ahead data. Buffering is continued while an opening is in the cache buffer memory 4 (S9).

[0010]

[Problem(s) to be Solved by the Invention] As explained above, in an optical disk medium only with one layer of data layers like CD, seeking control is only performed in parallel, i.e., horizontally, to a medium. However, seeking of a perpendicular direction for the optical disk medium which has a two-layer (plurality) information recording layer like DVD to go a data layer back and forth is added. In the program code of the sector of the 1st layer, user data and the program code of the sector of a two-layer eye, or user data After reproducing the data from the 0th street of the 1st layer to the 10th street, the 10010th street is reproduced from the 10000th street of a two-layer eye. Again for example, like the 10020th street from the 11th street to the 20th street [ 10011st ] It will be possible that what is reproduced by turns frequently exists, and seeking between the layers of a frequent perpendicular direction will occur in that case.

[0011] When accepting such a playback demand, by the playback approach like the former, it will occur mostly that there are no target data on cache buffer memory, and much latency times for seeking between layers will occur by rereading data each time.

[0012] When playback directions which go back and forth between layers briskly as mentioned above are issued, by reducing the count of seeking between layers, this invention makes the latency time by seeking the minimum, and aims at offering the optical disk playback approach and optical disk unit which can transmit data promptly to a requiring agency.

[0013]

[Means for Solving the Problem] It was made in order that this invention might solve the above-mentioned technical problem, and the storage region of a temporary storage means has two or more fields corresponding to the recording layer of an optical disk, and the 1st layer and each recording layer of the two-layer eye of an optical disk are the optical disk units corresponding to the storage region of the temporary storage means of dedication respectively.

[0014] And the demanded data are read and transmitted to the storage region of the temporary storage means only for the 1st layer about the 1st layer. Next, a read ahead is advanced about the 1st layer until the demand to a two-layer eye comes. If a demand occurs about a two-layer eye, it will read to the storage region of the temporary storage means only for two-layer eyes, and will transmit to it. After transmitting, a read ahead is continued about a two-layer eye. Moreover, although data will be transmitted from the storage region of the temporary storage means only for the 1st layer if a demand occurs about the 1st layer, a read ahead is taken as the optical disk playback approach which carries out cache control so that it may continue about a two-layer eye.

[0015] Since the rate of possession at the time of the data retrieval within a temporary storage means can be raised and the count of seeking between layers becomes fewer by performing the above optical disk playback approach, the latency time can be shortened to a requiring agency, information can be returned, and the high-speed optical disk playback approach and a high-speed optical disk unit can be offered in this way.

[0016]

[Embodiment of the Invention] Claim 1 of this invention, and invention according to claim 2 The optical reading means which reads information from the optical disk which has two or more information recording layers, A temporary storage means to memorize temporarily the information read with the

optical reading means, When a read-out demand of information is received, it has a read-ahead means to memorize for a temporary storage means with an optical reading means until a temporary storage means expires for the information following current storage information. A temporary storage means has two or more fields corresponding to the number of information recording layers, and the field with a temporary storage means memorizes the information on an information recording layer with an optical disk with a read-ahead means. Other fields of a temporary storage means are optical disk units characterized by memorizing the information on other information recording layers of an optical disk with a read-ahead means.

[0017] When playback directions which go back and forth between layers briskly are issued according to this invention, by reducing the count of seeking between layers, the latency time by seeking can be made into the minimum, and the optical disk unit which can transmit data promptly to a requiring agency can be offered.

[0018] Hereafter, the gestalt of operation of this invention is explained according to drawing.

(Gestalt 1 of operation) Drawing 1 is the configuration block Fig. of the optical disk unit in the gestalt of operation of this invention. 11 is an optical disk which has two or more information recording layers, and is taken as the optical disk which has a two-layer (plurality) information recording layer like DVD especially with the gestalt 1 of this operation. For an optical pickup module and 13, as for cache buffer memory and 16, the access-control section, and 14 and 15 are [ 12 / the data-processing section and 17 ] controllers. Although each of these components have the same conventional function and same conventional name as a component, the optical pickup module 12 and the access-control section 13 shall have a function corresponding to two-layer [ of an optical disk (DVD) 11 ], high density record, and large capacity.

[0019] Drawing 2 is the flow chart of the buffer control program of the controller 17 of drawing 1.

Hereafter, according to drawing 2, it explains for every step of operation. The access-control section 13 controls actuation of the optical pickup module 12 by focal control, tracking control, and spindle control. First, it enables it to read the data of an optical disk 11 from the optical pickup module 12, a controller 17 starting an optical disk unit and applying a servo in order of focal control, tracking control, and spindle control (S21). A controller 17 waits for the lead demand from the data-processing section 16 (S22). Generating of a lead demand performs the extract of a lead starting address and the number of lead demand sectors to the generated lead demand. Here, the data of the 1st layer shall be memorized on the 1st cache buffer memory 14, and the data of the 2nd layer shall be memorized to the cache buffer memory 15 of the 2nd layer.

[0020] It judges where [ on a disk ] data are with the extracted address (S23), and suppose that it was it a thing on the 1st layer. A selector is set to the direction of the 1st cache buffer memory 14 (S24), and it searches whether the target data are on the 1st cache buffer memory 14 (S26). When there are data, the target data are transmitted to the data-processing section 16 (S33). A transfer makes an availability the part which was repeated about the demanded number of sectors (S34), and was transmitted, and starts a read ahead of new data (S35).

[0021] Data are read when there are no data. Temporarily, suppose that the address and the number of sectors which were extracted were the 100th 1 sector. It seeks to the 100th street of an optical disk 11 with the optical pickup module 12 (S27), and read-out of data is started (S28). The read data are buffered from the head of the 1st cache buffer memory 14 (S29), an error correction is given, and only 1 sector is transmitted to the data-processing section 16 (30 S 31). The data of the 101st henceforth which was not transmitted are buffered and stored in the 1st cache buffer memory 14 as read-ahead data. Buffering is repeated while an opening is in the 1st cache buffer memory 14 (S32).

[0022] Temporarily, supposing the capacity of the cache buffer memory 14 is a part for 50 sectors, it is buffered to the 150th street. If an opening is lost to the cache buffer memory 14, buffering will be in a standby condition until it is stopped and an opening occurs (i.e., until the next lead demand occurs) (S22).

[0023] Or again, the extract of a lead starting address and the number of lead demand sectors is performed to the generated lead demand, and if a lead demand occurs in the midst (S22) which predicts

data (S22), if the extracted address is a thing on the 1st layer, it will search whether the target data are on the 1st cache buffer memory 14 to it (S26). When there are data, the target data are transmitted to the data-processing section 16 (S33). A transfer makes an availability the part which was repeated about the demanded number of sectors (S34), and was transmitted, and starts a read ahead of new data (S35).

[0024] When there are no data, the read ahead till then is interrupted, it seeks according to the extracted address (S27), and read-out of data is started (S28). The read data are buffered from the head of the 1st cache buffer memory 14 (S29), and an error correction is given to them and they are transmitted to the data-processing section 16 about the demanded number of sectors (S30). The data which were not transmitted are buffered and stored in the 1st cache buffer memory 14 as read-ahead data.

[0025] Buffering is repeated while an opening is in the 1st cache buffer memory 14 (S32). Moreover, if the extracted address is a thing on the 2nd layer, it will change a selector to the direction of the 2nd cache buffer memory 15 (S25). It searches whether the target data are on the 2nd cache buffer memory 15 (S26). When there are data, the target data are transmitted to the data-processing section 16 (S33). A transfer makes an availability the part which was repeated about the demanded number of sectors (S34), and was transmitted, and starts a read ahead of new data (S35).

[0026] Data are read when there are no data. Temporarily, suppose that the address and the number of sectors which were extracted were the 10000th 1 sector. The optical pickup module 12 performs seeking between layers (S27), and starts read-out of data from the 10000th street of an optical disk 1 (S28). The read data are buffered from the head of the 2nd cache buffer memory 15 (S29), an error correction is given, and only 1 sector is transmitted to the data-processing section 16 (S30).

[0027] The data of the 10001st henceforth which was not transmitted are buffered and stored in the 2nd cache buffer memory 15 as read-ahead data. Buffering is repeated while an opening is in the 2nd cache buffer memory 15 (S32). If an opening is lost to the cache buffer memory 15, buffering will be in a standby condition until it is stopped and an opening occurs (i.e., until the next lead demand occurs) (S22).

[0028]

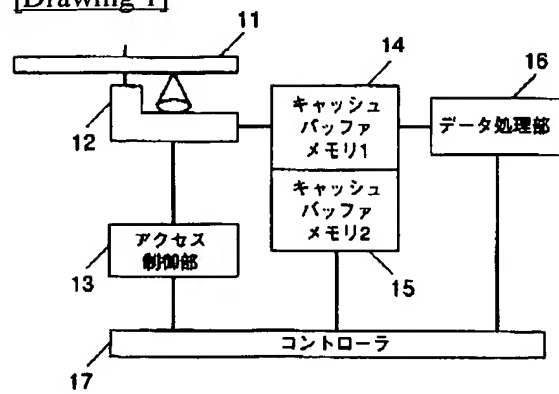
[Effect of the Invention] As mentioned above, by buffering with the cache buffer memory which became independent for every layer according to this invention when a lead demand is published, while having transmitted data from the cache buffer memory of the method of one -- already, since a read ahead of the method of one is continuable To a lead demand which carries out the alternation of between layers frequently, the rate of possession of read-ahead data increases, and when already buffered, data can be immediately transmitted to a requiring agency. Even when not buffered, it is effective in the ability to reduce seeking between layers to the minimum.

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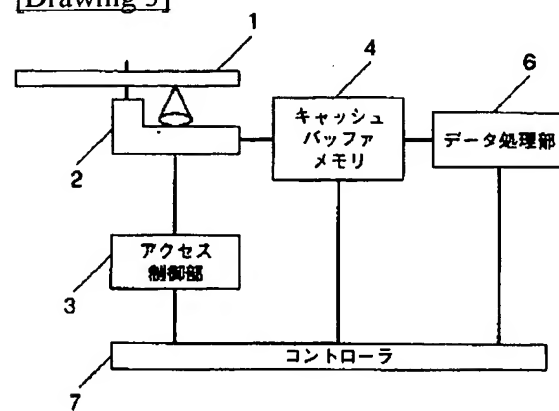
[Translation done.]

## DRAWINGS

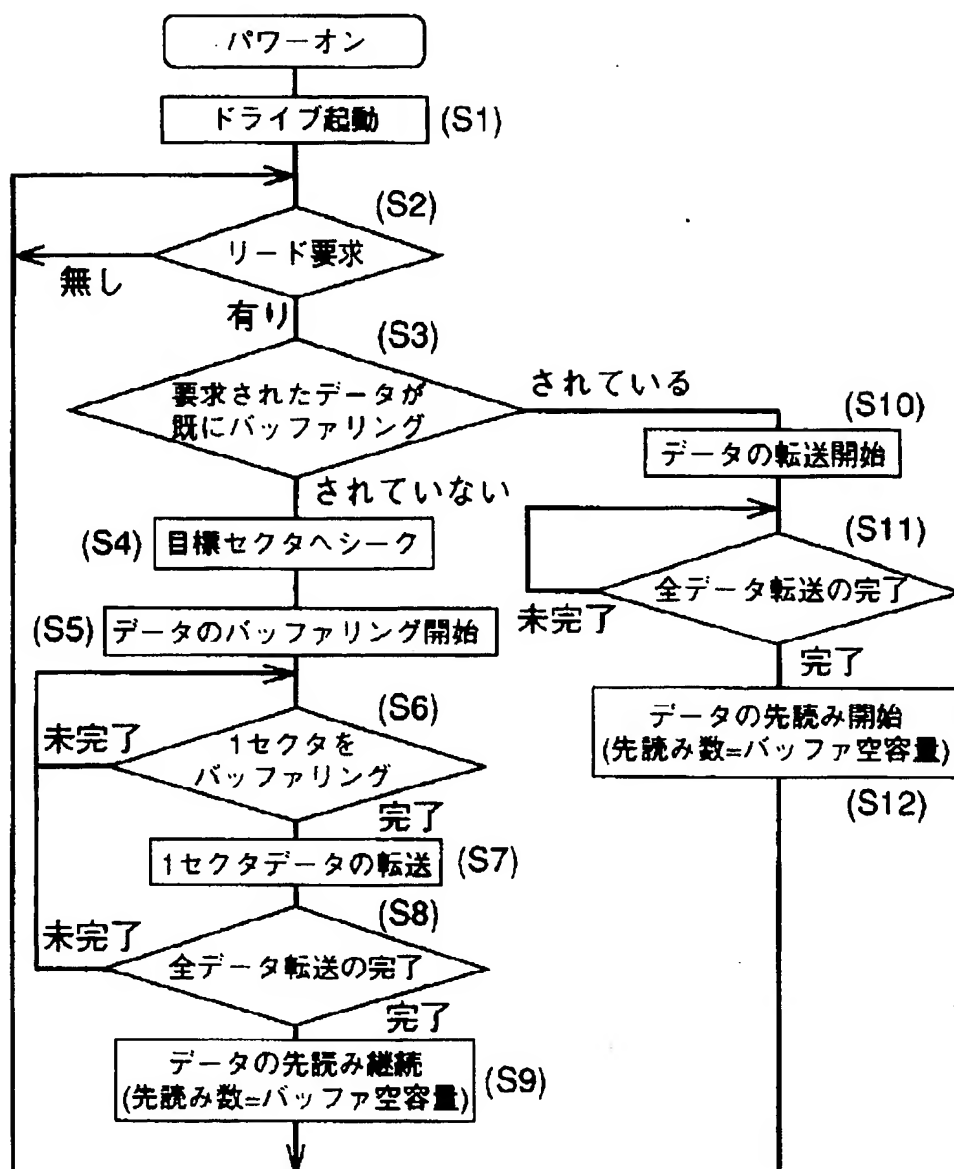
[Drawing 1]



[Drawing 3]

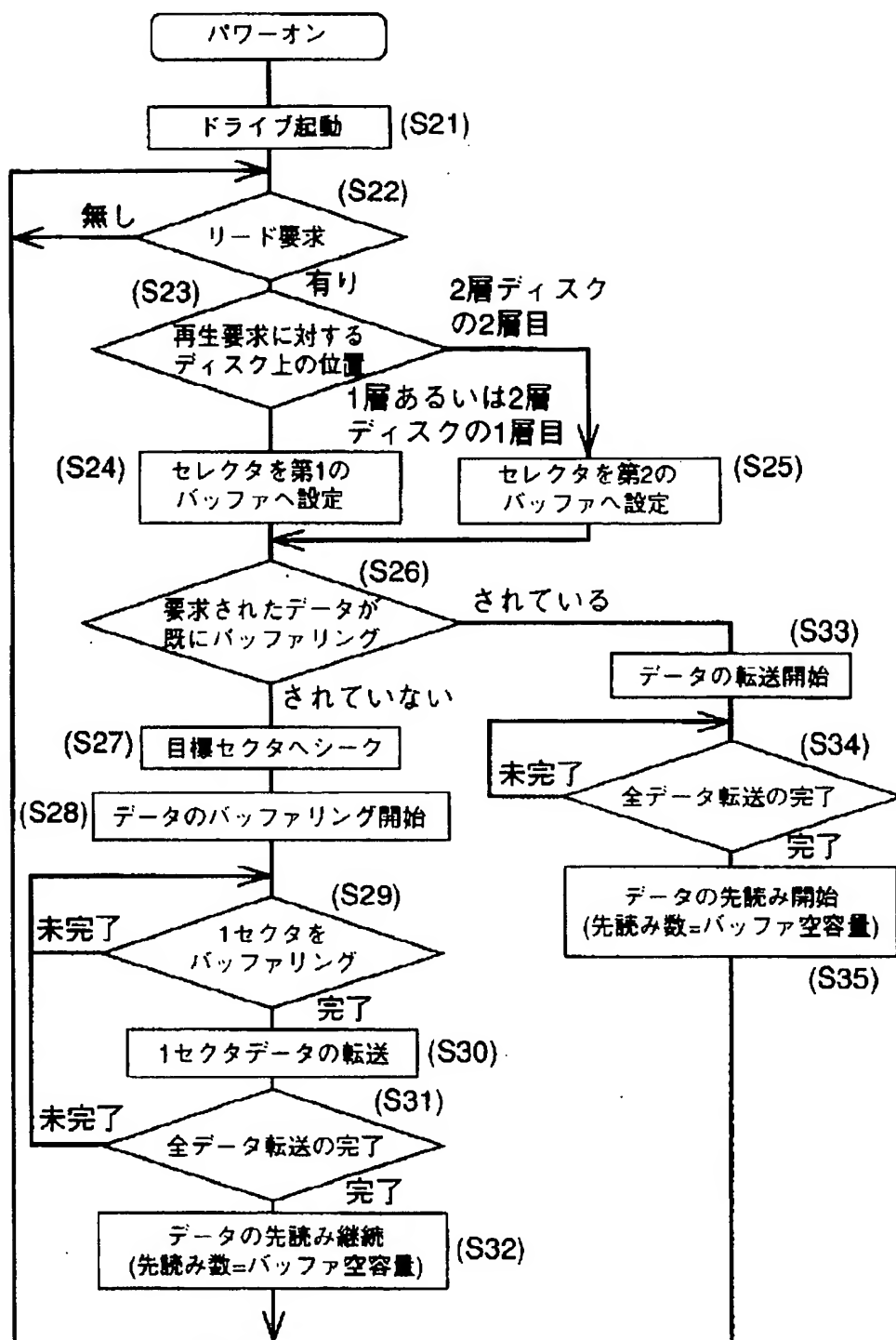


[Drawing 4]



[Drawing 2]





## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] The configuration block Fig. of the optical disk unit in the gestalt of operation of this invention

[Drawing 2] The flow chart of the buffer control program of the controller of drawing 1

[Drawing 3] The configuration block Fig. of the conventional optical disk unit

[Drawing 4] The flow chart of the buffer control program of the controller of drawing 3

### [Description of Notations]

1 Optical Disk (CD-ROM)

2 12 Optical pickup module

3 13 Access-control section

4, 14, 15 Cache buffer memory

6 16 Data-processing section

7 17 Controller

11 Optical Disk (DVD)